

[002] This application is a national stage completion of PCT/EP2003/011453 filed October 16, 2003 which claims priority from German Application Serial No. 102 49 048.1 filed October 22, 2002.

[003] FIELD OF THE INVENTION

[004] ~~According to the preamble of claim 1, t~~ The invention relates to a switching device. ♦♦

[005] BACKGROUND OF THE INVENTION

[010] SUMMARY OF THE INVENTION

[012] BRIEF DESCRIPTION OF THE DRAWINGS

[013] The invention ~~[[is]] will now be described in detail, by way of example, with~~ reference to ~~a drawing~~ the accompanying drawings in which ~~[[shows]]:~~ ♦♦

[017] DETAILED DESCRIPTION OF THE INVENTION

[027] In a reverse switch from the fourth gear to the third gear of the vehicle transmission 4, the clutch is first opened and air abuts on the central air supply. As already shown, relative to the other alternative, in the main transmission part 6 of the vehicle transmission (shown here), three forward gears and one reverse gear are provided so that the first three forward gears are conducted with the slow position GPL of the auxiliary-section transmission part 10 and the fourth forward gear corresponds to the position of the first forward gear in the main transmission part 6 combined with the quick position GPS of the auxiliary-section transmission part 10. In the position for the fourth gear as initial position for the reverse switch to be next described, the selector finger 38 is in the area of the selector rod 42 in a position offset to the right contrary to the position, shown in Fig. 3, so that the selector rod 42 has engaged the first gear in the main transmission part 6. To that end, the connecting line 22 is aerated on the actuator 12. The connecting lines 26 and 28 are also simultaneously

aerated on the actuator 18 in order to keep the selector finger 38 in this position according to the arrow directions 20. The connecting line 22 is then de-aerated. Due to the de-aeration of the connecting line 28 in the drawing plane of Fig. 3, the selector finger 38 is moved upward until it can engage in the aperture in the selector rod 44 in the position GPS. Thereupon the connecting lines 22 and 24 are again aerated and the selector finger 38 moves the selector rod 44 until reaching the position N. The auxiliary-section transmission part 10 is thus switched to the neutral position while the main transmission part 6 remains in the first gear. The connecting lines 22 and 24 are de-aerated. By additional aeration of the connecting line 28, the selector finger 38 moves downwards in the drawing plane of Fig. 3 until it cannot continue on its way in this direction, since it strikes against the selector rod 42. By an additional aeration that follows of the connecting line 22 in the drawing plane of Fig. 3, the selector finger 38 moves to the right in the clearance 40 between the selector rod 44 and the selector rod 42 until it can engage in the position for the first gear in the aperture in the selector rod 42; the movement of the selector finger 38 in direction to the aperture being maintained by the actuator 18 and the obstacle to continuing the downward movement of the selector finger 38 in the drawing plane when reaching the aperture being eliminated. After reaching the rotational speed needed for switching the main transmission part 6, the connecting line 22 is de-aerated and the connecting line 24 aerated and, in the drawing plane, the selector rod 42 switches to the left until the switching position for the third gear is reached in the main transmission part 6. Thereupon the vehicle clutch is closed. For final switching in the auxiliary-section transmission part 10, the connecting lines 22 and 24 are now de-aerated in order to prevent movement of the selector finger 38 in the first place. By de-aeration of the connecting line 28, the selector finger 38 is moved upward in the drawing plane of Fig. 3 until it cannot continue on its way in this direction for having stricken against the selector rod 44. By simultaneous aeration that follows of the connecting lines 22 and 24, the selector finger 38, in the drawing plane of Fig. 3, moves to the right in the clearance 40 between the selector rod 44 and the selector rod 42 until it can engage in the position N in the aperture in the selector rod 44; the movement of the selector finger 38 in direction to this aperture being

maintained by the actuator 18 and the obstacle to continuation of the upward movement of the selector finger 38 in the drawing plane being eliminated when the aperture is reached. The selector finger 38 remains in this position first until reaching the engine rotational speed required for switching in the auxiliary-section transmission part 10. As soon as the desired rotational speed has been reached, the connecting line 22 is de-aerated and the selector finger 38 moves the selector rod 44 until the position GPL is reached. The connecting line 24 is de-aerated. The additional aeration of the connecting line 28 results in that the selector finger 38 is moved downwards in the drawing plane of Fig. 3 until, in the position of the switched third gear of the main transmission part 6, it can engage in the aperture in the selector rod 42. Finally the central air supply is switched off.

[028] The switching sequence of another switching in the main transmission part 6 and auxiliary-section transmission part 10 is now described, likewise with reference to Fig. 3. In this alternative, the auxiliary-section transmission part 10 is also provided with a dog clutch engagement. In an upshift from the third gear to the fourth gear of the vehicle transmission 4, the clutch is first opened and air abuts on the central air supply. In the position for the third gear as starting position for the upshift to be described, the selector finger 38 is in the area of the selector rod 42 in a position offset to the left, unlike the position shown in Fig. 3, so that the selector rod 42 has engaged the third gear in the main transmission part 6. For the purpose, the connecting line 24 on the actuator 12 is aerated. The connecting lines 26 and 28 on the actuator 18 are also simultaneously aerated in order to keep the selector finger 38 in this position, according to the arrow direction 20. The connecting line 24 is additionally de-aerated. By the de-aeration of the connecting line 28, the selector finger 38 is moved upwards in the drawing plane of Fig. 3 until it can engage in the position GPL in an aperture in the selector rod 44. Thereupon the connecting lines 22 and 24 are again aerated and the selector finger 38 moves the selector rod 44 until reaching the position N. The auxiliary-section transmission part 10 is thus switched to the neutral position while the main transmission part 6 remains in the position for the third gear. The connecting lines 22 and 24 are de-aerated. By additional aeration of the connecting line 28, the selector finger 38 moves downwardly in

the drawing plane of Fig. 3 until it cannot proceed on its way in this direction by striking against the selector rod 42. By an additional aeration that follows of the connecting line 24 in the drawing plane of Fig. 3, the selector finger 38 moves to the left in the clearance 40 between the selector rod 44 and the selector rod 42 until it can engage in the position for the third gear in the aperture in the selector rod 42, the movement of the selector finger 38 in direction to the aperture being maintained by the actuator 18 and the obstacle to the continuation of the downward movement of the selector finger 38 in the drawing plane being eliminated. After reaching the rotational speed needed for switching in the main transmission part 6, the connecting line 24 is de-aerated and the connecting line 22 aerated and the selector rod 42, in the drawing plane, switches to the right until reaching the switching position for the first gear in the main transmission part 6. Thereupon the vehicle clutch is closed. For the final switching in the auxiliary-section transmission part 10, the connecting lines 22 and 24 are now de-aerated in order next to prevent a movement of the selector finger 38. By de-aerating the connecting line 28, the selector finger 38 is moved upwards in the drawing plane of Fig. 3 until it cannot continue on its way in this direction since it strikes against the selector rod 44. By a simultaneous aeration that follows of the connecting lines 22 and 24, the selector finger 38, in the drawing plane of Fig. 3, moves to the left in the clearance 40 between the selector rod 44 and the selector rod 42 until, in the position N, it can engage in the aperture in the selector rod 44, the movement of the selector finger in direction to the aperture is maintained by the actuator 18 and the obstacle to continuation, in the drawing plane, of the upward movement of the selector finger 38 until reaching the aperture being eliminated. In this position, the selector finger 38 remains mainly until reaching the engine rotational speed required for switching in the auxiliary-section transmission part 10. As soon as the desired rotational speed has been reached, the connecting line 24 is de-aerated and the selector finger 38 moves the selector rod 44 until reaching the position GPS. The connecting line 22 is de-aerated. The additional aeration of the connecting line 28 results in that the selector finger 38, in the drawing plane of Fig. 3, is moved downwards until it can engage in the position of the

switched first gear of the main transmission part 6 in the aperture in the selector rod 42. The central air supply is finally switched off.

- [029] By the design described, it is possible for switching the auxiliary-section transmission part 10 to eliminate a separate actuator with appertaining control and control valves, the same as the mechanical transmission needed between this actuator and the selector fork in the auxiliary-section transmission part 10. This operates with special advantage when a transmission originally laid out for four gear steps in the main transmission part 6 drops one of the gear steps whereby a selector rod can be eliminated. Thereby the number of gears of the vehicle transmission is certainly reduced but, in the switching expenses, can thereby be saved. ♦